Ethnographies of science education: situated practices of science learning for social/political transformation

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Abstract:

This article is an introductory essay to the *Ethnography and Education* special issue *Ethnographies of science education: situated practices of science learning for social/political transformation*.

Keywords: Science Education | Ethnography | Culture

Article:

Transforming science education has been cited as a global imperative in terms of: producing technological innovation to maintain economic security (Bybee and Fuchs 2006; Tytler 2007); creating critical consumers of scientific knowledge (Osborne and Dillon2008) and fostering a more environmentally sustainable and equitable world (Calabrese Barton 2001; Carter 2008). In light of these agendas, viewing science as a cultural process has significantly contributed to our understanding of the interplay between local micro-level contexts and macro-level political influences in the science classroom. Moreover, ethnography has chronicled the experiences of ethnically and linguistically diverse populations who have been historically excluded from participation in science. Cultural studies of science education speak directly to issues of economics, sustainability and inclusion but also address theoretical and empirical gaps in our understanding of science education and its context: 'What precisely is the nature of science, of nature, of culture, and of the relationship among them?' (Weinstein 1998, 486).

Researchers who conduct ethnography in science education tend to have a deep commitment for transforming science to become an agentic tool, one that improves the lives of people in underserved communities (Hammond and Brandt 2004). In this light, identity and agency – the human capacity for making choices and the ability to act upon these intentions – is viewed as

being both important in terms of learning science, as well as understanding social change in schools and the broader society. Yet, by taking up this stance, the ethnographer in science education is often at odds with the very practices that distinguish the sciences as a process of inquiry separate from other disciplines. Ethnographers of science education have opened up the science classroom to describe cultural practices surrounding the teaching and learning of science in the same way that sociologists have studied the construction of knowledge in the science laboratory (Collins 1982; Latour and Woolgar 1979/1986) and the socialisation of scientists-in-the-making (Knorr-Cetina and Mulkay 1983). Through their research, ethnographers of science education challenge the 'culture of no culture' (Subramaniam and Wyer 1998; Traweek 1988) and the prevalent myth of objectivism in science. As ethnographers examine the ways science is given meaning in schools, they ask: *What* is science education? *Whose* purposes does it support?

This special journal issue explores how contemporary ethnographers in science education study the local production of scientific knowledge and how this meaning-making is implicated in larger social and political struggles. The articles in this issue have a two-fold purpose. First, these articles offer examples of the socially and politically situated practices of science learning (in- and out-of-school contexts). Second, these articles highlight the tensions in critically examining science as a social practice while re-envisioning science education and science education policy. In this issue, we reconsider science education and the ways in which ethnographic research can contribute to its transformation. We argue that a cultural perspective of science education is essential for the design of more effective interventions – ones that expose, confront and seek to alter persistent structural inequities in schooling, while also addressing pressing global concerns of economic and environmental sustainability, health and social justice.

The ethnographic turn in science education

Ethnographies of science education are a relatively recent addition to educational research. As Delamont (1989) noted in her review of sociological approaches to science education, prior to the 1980s, sociological accounts of science classrooms in the UK were completely missing – and similarly, ethnography of science education in North American was non-existent. Prior to the 1980s, the emphasis in science education research was to emulate experimental studies in the scientific journals such as *Nature* or *Science* (Joslin et al. 2008). With the rise of social constructivism in science education research the late 1980s (Driver and Oldham1986), research in education moved from experimental studies focused on individual cognition to include studies of the context of science classrooms and the practices of teaching and learning science. In their international review of ethnographic studies in science education, Hammond and Brandt (2004) noted that few researchers in science education position themselves as anthropologists and similarly, the use of the term 'ethnography' or 'ethnographic' varies widely. Some researchers claim their work as ethnographic but are little more than interview studies or descriptive qualitative research in a naturalistic setting. Other qualitative studies provide microanalyses of social interactions of learning but avoid taking up a position on what constitutes 'culture' and the ways science education is reproduced in schools.

The ethnographic turn in science education did not emerge directly out of anthropology or sociology, nor was it influenced by the ways that early anthropologists or sociologists thought about culture. Instead, the work of Vygotsky (1978, 1986) and other Russian psychologists (Leont'ev 1978) in the early twentieth century played a major theoretical role in a sociocultural approach to learning and signalled a radical departure from Piaget's (1955) model of cognition. The turn towards understanding human practices of learning emerged from an interest on the context of socially situated activity (Lave 1993, 1997) and the ways that knowledge is socially constructed (Bruner 1996; Cole 1971). Naturalistic studies of classroom practice (Brown 1992; Brown and Campione 1994) developed from the field of cultural psychology whose researchers began to study the ways that social interactions and the role of language function in human learning.

When naturalistic studies of classrooms were introduced in academic journals during the late 1970s, controversy brewed in science education (Joslin et al. 2008) surrounding the appropriateness of qualitative methods for research and whether naturalistic studies could even be considered ‘research’ at all. Despite the dominance of positivism in educational research, early ethnographers in education were inspired by the work of Erickson (1986) to undertake detailed descriptions of classroom learning. Researchers like Ken Tobin (Siry 2009) argued for a departure from Piagetian theory to view science – and science education – as social and cultural process.

We emphasise the origins of an ethnographic turn in science education to underscore the ways that the individual is theorised in relation to larger cultural processes and institutions. Reform in science education (as in education in general) has consistently focused on measuring the individual – the role of the teacher or assessing the motivation and success of the student – without considering a more systemic approach to examining cultural, institutional or global contexts of educational resources and knowledge. Ethnography is one way to broaden this lens to incorporate those aspects of human practice formerly viewed as peripheral, deemed unimportant or judged as ancillary to science education.

Elusive venues for the publication of ethnography in science education

Science education journals in the early 1980s began opening the door to the publication of a wide variety of qualitative studies and with these, the very first ethnographies of science education.[1] Other academic journals quickly followed suit and several top-ranked journals in science education currently publish ethnographic works alongside experimental studies. Even though international journals in science education now provide opportunities for publication of qualitative research, ethnographic studies have yet to be published in these venues. Despite a palpable shift in research in science education in North America, Australia and the UK, a ‘scientific’ approach to conducting educational research still dominates in South American, Asian, African, Eastern European and European science education journals – providing few locations for the publication of ethnographic studies. Our review of ethnography in science

education for this overview indicates that those researchers conducting science education in these countries either publish in North American science education journals or in the fields of anthropology and sociology.

The 'gatekeeping' effect of academic journals on ethnography in science education is undeniable, yet other factors have also influenced the rarity of ethnographic studies in science education. Despite a general increase in qualitative research in education, 'scientifically based research' has been favoured for grant funding and designated as superior through national agendas and government policies (Berliner 2002; Eisenhart 2006; Phillips 2002, 2005). In this paradigm, experimental studies, hypothesis testing and control groups are favoured, while ethnography is deemed a 'soft' approach lacking validity or generalisability. Similarly, many graduate programmes in science education now include instruction in qualitative approaches (interviewing, participant observation and the collection/analysis of cultural artefacts) especially if taught as complementary to quantitative measures and sanctioned as part of 'mixed methods'. Yet, ethnography in graduate education as both methodology *and* ontology continues to be uncommon.

In sum, as education research continues to open up dialogues around 'ecological' frameworks of learning and development (Barab and Roth 2006; Barron 2006; Bronfenbrenner 1979; Lee 2008), we see an opportunity to promote ethnography as a means of advancing more equitable practices in science education. In addition, we wish to encourage science education to look beyond the individual to consider how meaning is shared widely, that is – how science 'culture' is expressed and implicated across sites of learning. Too often, sociocultural studies in science education end at the classroom walls and the interplay between micro-level practices and larger macro-level institutions go unacknowledged. Also, with a focus on the individual (or individual cognition), group/institutional norms tied to discriminatory and exclusionary practices often remain unchallenged and unexamined.

The organisation of this special issue

This special issue brings together ethnographers in science education to contribute a global perspective on science teaching and learning in school and university classrooms, at home and after school programmes. The settings and actors are diverse and constitute 'science', defined broadly. This issue includes examples of ethnography in science education from the UK, Argentina, Canada and USA. Four of the contributions are focused on science education in public schooling, while the other three examine science learning in out-of-school contexts. Three cross-cutting themes dominate the articles in this issue: (1) ethnography as an approach to articulate the tensions between institutional norms of 'scientific knowledge' and local meaning-making that occurs in the lives of students and teachers; (2) ethnography as an analytical tool for teacher self-reflection and transformative action and (3) ethnography as a strategy to map the ways that youth position themselves or are positioned through time and space as they participate in science education.

Carlone and Johnson's article leads this issue by exploring the various ways that culture is theorised in science education. The authors take up three anthropological approaches common in science education (funds of knowledge, third space/hybridity and practice theory) to debate the advantages and limitations of each framework. Carlone and Johnson raise an important point, whereby researchers attend closely to the ways in which cultural repertoires (or particular cultural elements) are elevated and are unintentionally essentialised in an attempt to explain inequities in schooling. The authors point out the potential hazard in which theoretical underpinnings fail to account for the ways science as a culture reproduces itself, and how science is connected to larger systems of power. By examining 4 years of ethnographic data in American public school science classrooms, Carlone and Johnson illustrate the need for a theoretical lens that can accommodate nuances and subtle differences in local practices and the socio-historical shaping of local meaning over time. Using the case of Julio, a Mexican immigrant student, they argue that the strength of practice theory lies in its ability to view meaning-making among individuals and groups, as being shaped *and* shaping larger macro-level structures.

In their ethnography of a primary teacher education programme in the UK, Colucci-Gray and Fraser adopt a framework based on a heightened awareness of language and one's own experience as an ‘interpretative key’ in a science education class. Taught in a way that emphasised students’ co-construction of knowledge and science as cultural process, this unfamiliar strategy created unexpected tensions for the students and their instructors, especially when students demanded content and a more rigid presentation of science. Colucci-Gray and Fraser found those students who had experience in cultural ‘border-crossing’ at the university (in this case, Spanish exchange students) were better able to adapt to this innovative curriculum. These authors ask important questions concerning the design of elementary teacher education whereby potential teachers (and consequently their own students) are empowered towards greater democratic participation in science. Articulating these tensions was a decisive step towards the redesign of their course.

Likewise, Long's ethnography exposed tensions among the students and faculty surrounding the presentation of evolution in college-level biology courses. In his ethnography of undergraduates and faculty at regional university in the religiously conservative Midwestern USA, Long explored the ways students who identify as Creationists struggled with describing conflicted feelings about evolution while participating in the science course. Faculty, however, glossed-over and denied students a discursive space in which they could examine the nature of science in relation to their religious beliefs. Long views ethnography as a means for articulating what seem to be incommensurable beliefs about science and schooling, but also as an avenue for informing educational policy that promises more democratic participation.

Traianou's ethnography of a primary schoolteacher in the UK examined the use of a ‘dilemmatic’ approach for one's self-examination of science teaching. By identifying the contradictory patterns of schooling, teachers can identify tools for investigating practice and transforming it. In the context of high stakes testing, the teacher in Traianou's study confronted several dilemmas

during the teaching of physical forces; these dilemmas highlighted aspects of her practice that grappled with societal norms of what constitutes ‘scientific’ knowledge and logical reasoning as opposed to her students’ everyday meaning-making. The teacher in Traianou's study used the language of dilemmas to explore the competing pressures under which teachers operate and their thinking in the decision-making process. Traianou argues that using a dilemmatic approach in teacher education can facilitate an examination of one's own practice, an essential element of being a *bricoleur* who is engaged in boundary work, which requires a new trans-disciplinary consciousness (Kincheloe 2001).

Padawer's ethnography of children's knowledge about the natural world in the *Mbyá-Guaraní* communities of Argentina typifies much of rural South America where indigenous communities find themselves swept up in rapid economic and environmental change. As a backdrop to her ethnography, Padawer described the colonial past in rural Argentina whereby peasant squatters have encroached on indigenous communities through their participation in agriculture and an economy based on the extraction of forest products. As might be expected, the knowledge base of peasant and indigenous youth in the same school was the result of economic practices they shared with adults outside their homes. However, as recent global flows have shifted competition – economic roles and land ownership have been altered as well, impacting the ways that youth learn about the natural world and local ecology. By mapping local knowledge among youth and the spaces in which they construct these understandings, Padawer advocates that schools take advantage of children's everyday experiences to teach science education in schools and to challenge naive textbook representations of indigenous and peasant land-use practices.

In her ethnography of immigrant girls in an afterschool programme in urban Montreal, Rahm followed the trajectory of two teenage girls as they moved between school, home and community, over time. Rahm observed the girls’ identity work in a science literacy programme and described how they carved out locations for participation as they actively positioned themselves through dialogue and writing. The girls sought out different pathways for participation: those avenues that were publicly valorised, as well as those that were marginalised. Rather than viewing ‘multi-sited’ ethnography as simply ‘adding sites’ of study to her research, Rahm argues for this approach to ethnography requiring new roles for the researcher as part of a ‘collaborative imaginary’ to view participants as they move through time-space. Rahm cautions educational researchers to bear in mind that as girls accrue sets of experiences, such experiences do not necessarily translate into increased agency or one's long-term participation in science but instead reflects the complexity of identity work.

Similarly, Tzou and Bell use critical spatial theory to examine the borders that demarcate ‘place’ among youth in an after school, environmental education programme in the western USA. The authors examined the discursive boundaries of fear and privilege in an environmental education curriculum surrounding what constitutes ‘safe and unsafe’ consumer beauty products and their impact on local water quality. As youth explored the range of meanings in this curriculum, Tzou

and Bell describe one youth's 'counterscript' of his racial and ethnic heritage in after school programme, as he actively resisted the 'boundary-making' in the curriculum. This young man actively positioned himself on the margins of the activity as a location where he could express his 'Mexican-ness', while at the same participating in the curriculum. The authors argue that through ethnography educators can (re)design curricula that probe the dialectical relationship between the local production of scientific knowledge and larger socio-political narratives in environmental education.

To summarise, these articles illustrate the range of the pressing problems that characterise science education in rapidly changing global economy at a time when increasingly conservative ideologies are being 'mainstreamed' in public education. These articles express the many ways in which democratic participation in science education is being challenged. We believe the research assembled for this issue will be a resource for novice as well as more established scholars in science education, science-technology-society studies, and anthropology/sociology who wish to explore cultural studies of science in education. This collection of scholarship points to the complicated ways that larger political and governmental ideologies shape the ways youth and adults construct their understanding about the natural and physical world. Authors in this issue explored ways that ethnography opened up new understandings of the tensions surrounding science education reform using a variety of analytical frameworks. These articles point to promising directions for theorising the 'culture' of science education as we undertake educational reform. Indeed, ethnography is not only a valid approach for the study of science education; it is essential to the development of more equitable practices for instruction and learning.

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Notes

1. We would be remiss if we did not mention that several ethnographic monographs that have been central to an anthropological approach to science education: Eisenhart and Finkel's (1998) *Women's science: Learning and succeeding from the margins* and Nespor's (1994) *Knowledge in motion: Science, time, and curriculum, in undergraduate physics and management*. Recently new ethnographic monographs have been published by Rahm (2010) and Long (2011).

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